REMARKS

Claims 1-22 are pending in this application, of which claims 1, 4, 8, 9, 12, 15, 19, and 20 are independent. Applicant acknowledges, with appreciation, the Examiner's allowance of claim 4, 8, 9, 15, 19, and 20.

In this Amendment, claims 1-20 have been amended. Care has been exercised to avoid the introduction of new matter. Support for the present amendment can be found in, for example, paragraph [0037] of the specification.

Claims 1, 5, 12 and 16 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Zhou et al., in view of Deng et al., and further in view of Essiambre et al., and further in view of Miller.

In the statement of the rejection, the Examiner asserted that the applied combination of Zhou et al., Deng et al., Essiambre et al., and Miller teaches an optical transmission system of the claims. Applicant respectfully traverses this rejection.

Applicant submits that Zhou et al., Deng et al., Essiambre et al., and Miller, either individually or in combination, do not disclose or suggest an optical transmission system including all the limitations recited in independent claim 1 which reads:

> 1. A CWDM (Coarse Wavelength Division Multiplexing) optical transmission system, comprising:
>
> an optical transmitter including a non-temperature controlled direct modulation light source, said optical transmitter outputting CWDM signal light in a signal wavelength band;
>
> an optical receiver receiving the signal light outputted from said optical transmitter;
>
> an optical fiber transmission line for transmitting the signal light outputted from said optical transmitter as a transmission medium provided between said optical

transmitter and said optical receiver, said optical fiber transmission line having a positive chromatic dispersion at an operation wavelength of said direct modulation light source; and

at least one non-temperature controlled dispersion compensator provided on an optical path between the signal outputting end of said optical transmitter and the signal entering end of said optical fiber transmission line,

wherein, at the signal emitting end of said optical fiber transmission line, the accumulated chromatic dispersion is set to negative over a temperature range of 0°C to 60°C, and

a wavelength range for the dispersion compensation is a range without a zero-dispersion wavelength of said transmission line.

The subject matter disclosed in the present application is directed to an optical transmission system transmitting "CWDM" signal light, and using an optical fiber with a positive chromatic dispersion and a non-temperature controlled direct modulation light source. Signal wavelength spacing in a "CWDM" system is wide, and therefore the "CWDM" system can effectively operate even in the temperature-unstable condition. In this manner, by using non-temperature controlled devices, the "CWDM" system can be obtained at a low cost. On the other hand, signal wavelength spacing in a "DWDM" transmission system is narrow, and therefore the "DWDM" system cannot operate in a temperature-unstable condition. This indicates that the "DWDM" system cannot use non-temperature controlled devices. The use of such a non-temperature controlled direct modulation light source provides the following benefits: signal light to be outputted has a positive chirp and pulse compression can be obtained in a negative chromatic dispersion condition. The optical fiber with a positive chromatic dispersion causes expansion of signal pulse, but this problem is suppressed by a dispersion compensator.

The cited references do not teach that the direct modulation light source is itself a non-temperature controlled one and that the dispersion compensator is also a non-temperature controlled one. When the dispersion compensator, provided between the optical transmitter and

the optical fiber transmission line, is a non-temperature controlled one, the accumulated chromatic dispersion of the signal light at the operation wavelength becomes negative over a temperature range of 0°C to 60°C, at the signal emitting end of the optical fiber transmission line. A non-temperature controlled dispersion compensator can be provided between the optical fiber transmission line and the optical receiver, which defines the accumulated chromatic dispersion at the signal receiving end of the optical receiver. Even when a non-temperature controlled device is used, the "CWDM" transmission system can obtain a high reliability.

(A) The Examiner admitted that Zhou does not teach that the optical transmitter light source is a non-temperature controlled direct modulation CWDM light source. However, the Examiner asserted that Deng teaches that inexpensive, non-temperature controlled lasers in WDM systems can be used with sufficient wavelengths spacing, and thus, cures the deficiency of Zhou. Applicant respectfully disagrees with the Examiner's position.

Zhou's system is directed to a "DWDM" system and the Deng's system is directed to a "CWDM" system. If a non-temperature controlled direct modulation light source is applied to the Zhou's "DWDM" system, the system becomes unstable because, as discussed above, the DWDM system cannot operate in a temperature-unstable condition and cannot use a non-temperature controlled device.

Furthermore, the Examiner asserted that Zhou's general use of the term "DWDM" does not disable the modification of Zhou's wavelength spacing based on Deng (see the first full paragraph on page 9 of the Office Action). The term "DWDM" is considered to be important to describe the subject matter of Zhou. Changing the wavelength spacing of Zhou's "DWDM" system to that of Deng's "CWDM" means changing Zhou's system from the "DWDM" system

to the "CWDM" system. Accordingly, the modified Zhou's system cannot achieve a high speed "DWDM" transmission.

With respect to setting of a chromatic dispersion, a band to be used in the CWDM system is wide because wavelength spacing is wide, whereas a band to be used in the DWDM system is narrow. For example, the band to be used in the CWDM system includes the three bands of S, C and L, but the band to be used in the DWDM system is limited to just one of those bands. The dispersion setting in the wider band, i.e., the dispersion setting in the CWDM system, is different from that in the DWDM system. On the other hand, Essiambre et al. teaches both of a positive dispersion setting and a negative dispersion setting are settable in accordance with various different conditions. However, the Examiner does not address any setting condition and any difference between CWDM and DWDM.

Accordingly, it is apparent that Deng et al. does not cure the deficiencies of Zhou et al.

(B) The Examiner admitted that Zhou does not teach that at the signal emitting end of the optical fiber transmission (or at the signal receiving end of the optical receiver), the accumulated chromatic dispersion is set to a negative. However, the Examiner asserted that Essiambre et al. teaches that using a small negative residual dispersion results in better transmission performance than a zero or slightly positive residual dispersion, and cures the deficiencies of Zhou et al.

The Examiner asserted that Essiambre et al. does not disclose "DWDM" (see the paragraph bridging pages 8 and 9 of the Office Action). However, Essiambre et al. mentions "50GHz" in paragraph [0036], indicating that Essiambre et al. addresses a dispersion in a "DWDM" system. In addition, the Examiner further asserted that wavelength spacing between channels in a WDM system is not relevant to the impact of a chromatic dispersion on individual

channels (see the paragraph bridging pages 8 and 9 of the Office Action). However, this assertion is incorrect. Because it is well-known that dispersion characteristics of any optical device (DCF, etc.) change depending on a temperature change. As compared with the "DWDM" system, the "CWDM" system is relatively susceptible to the dispersion characteristic change, for example, deforming of dispersion-wavelength curve, in relation to a small temperature change.

Accordingly, Essiambre et al. does not cure the deficiencies of Zhou et al.

(C) The Examiner admitted that Zhou et al. does not disclose the system operating over a temperature range of 0˚C to 60˚C. However, the Examiner asserted that Miller teaches that normal operation of temperature for optical fiber system is -40C° to 80C°, and cures the deficiency of Zhou. Applicant respectfully disagrees with the Examiner's assertion.

Applicant submits that the claimed temperature range of 0C° to 60C° is not an operation temperature for the CWDM system. The claimed temperature range is an environment condition when the accumulated chromatic dispersion is measured "at the signal emitting end of the optical fiber transmission line" (claim 1) or "at the signal receiving end of the optical receiver" (claim 12). The subject matter disclosed in the present application does not address the temperature range where the system operates, but addresses the issue as to whether a temperature-stability can be maintained or not even when the system operation temperature is set at any temperature within the room temperature.

The accumulated chromatic dispersion disclosed in the present application is a total chromatic dispersion obtained by adding the optical fiber transmission line and the non-temperature controlled dispersion compensator, and the optical fiber transmission line has a positive chromatic dispersion at an operation wavelength of the non-temperature controlled direct modulation light source. A chromatic dispersion of a dispersion compensating optical

fiber (DCF) itself also changes depending on a temperature fluctuation. That is, an optical fiber can maintain its negative chromatic dispersion even when a temperature fluctuation occurs.

In the case that chromatic dispersion D_l of an optical fiber transmission line in the temperature condition of 0°C to 60°C fluctuates within the range from D_{l1} to D_{l2} and chromatic dispersion D_{dc} of the non-temperature controlled dispersion compensating module in the temperature condition of 0°C to 60°C fluctuates within the range from D_{dc1} to D_{dc2} (the present application does not address a temperature condition because of the use of non-temperature controlled elements), the optical fiber disclosed in the present application may have chromatic dispersion D_{dc} satisfying the condition of $D_l + D_{dc} < 0$ and such an optical fiber constitutes a part of the disclosed dispersion compensating module. The temperature range of 0°C to 60°C in the claims does not mean the temperature range in which the dispersion compensating module itself is used. Meanwhile, the condition of $D_l + D_{dc} < 0$ may be set to the wider wavelength range of the CWDM system.

Accordingly, Miller does not cure the deficiencies of Zhou et al.

Based on the foregoing, Applicant submits that the applied combination of Zhou et al., Deng et al., Essiambre et al., and Miller does not teach an optical transmission system including all the limitations recited in independent claim 1 within the meaning of 35 U.S.C. §103. The above discussion is applicable to independent claim 12. Dependent claims 5 and 16 are also patentably distinguishable over Zhou et al., Deng et al., Essiambre et al., and Miller at least because these claims include all the limitations recited in independent claims 1 and 12, respectively. Applicant, therefore, respectfully solicits withdrawal of the rejection of claims 1, 5, 12, and 16 under 35 U.S.C. §103, and favorable consideration thereof.

Claims 2, 3, 6, 7, 13, 14, 17, and 18 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Zhou et al., in view of Deng et al., and further in view of Essiambre et al., and further in view of Miller, and further in view of Kartalopoulos; and claims 10, 11, 21, and 22 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Zhou et al., in view of Deng et al., and further in view of Essiambre et al., and further in view of Miller, and further in view of Gabitov.

Claims 2, 3, 6, 7, 10, and 11 depend from independent claim 1, and claims 13, 14, 17, 18, 21, and 22 depend from independent claim 12. Applicant thus incorporates herein the arguments regarding the rejection of claims 1 and 12 under 35 U.S.C. § 103 for obviousness predicated upon Zhou et al., in view of Deng et al., and further in view of Essiambre et al., and further in view of Miller. The Examiner's additional comments and reference to Kartalopoulos and Gabitov do not cure the deficiencies of the combination of Zhou et al., Deng et al., Essiambre et al., and Miller.

Applicant, therefore, respectfully solicits withdrawal of the rejections of claims 2, 3, 6, 7, 13, 14, 17, and 18 and of claims 10, 11, 21, and 22 under 35 U.S.C. § 103.

Conclusion

It should, therefore, be apparent that the imposed rejections have been overcome and that all pending claims are in condition for immediate allowance. Favorable consideration is, therefore, respectfully solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper,

including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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